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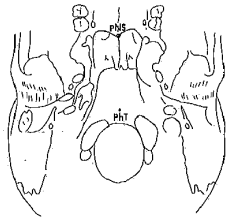
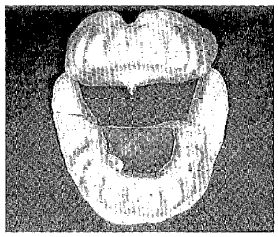


*The base of the skull showing the length of the pharynx from the posterior nasal spine (**PNS**). to the pharyngeal tubercal (**Pht**). (282)*



Intraoral record and drilled metallic platform in the positions: habitual, protrusive and lateral mandibular movements. (290)

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BEHAVIORAL SCIENCES

A Clinical Study of Specific Signs and Symptoms of CMD in Bruxers Classified by the Degree of Severity.

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ABSTRACT: Two hundred and seventy-six CMD patients referred consecutively for diagnosis and treatment over a period of four years were assessed. Two hundred and eleven were classified as bruxers according to the use of a questionnaire and clinical examination. One hundred (47.39%) presented clinical characteristics of mild bruxers, 66 (31.27%) presented moderate bruxism and 45 (21.32%) demonstrated severe bruxism. Severe bruxers presented the lowest degree of jaw opening (39.21 mm) and highest prevalence of capsulitis (97.77%), retrodiskal pain (84.44%) and disk-attachment pain (48.88%). As compared to the mild and moderate groups, severe bruxers also demonstrated significantly higher prevalence of protective splinting and transient locking or recent history of intermittent locking, masticatory pain, reciprocal clicking and signs and symptoms of Myofascial Pain Dysfunction Syndrome (MPDS). Because higher prevalence of specific muscle and joint disorders were observed in bruxers and such prevalence was progressive from the mild to the moderate and severe group, it may be concluded that bruxing behavior is a significant factor in the etiology and progression of muscle and joint disorders. Based on the review of the literature, the analysis of our data in comparison to other studies allowed us to conclude that severe bruxers are more impaired by muscular and joint disorders as compared to mild and moderate bruxers.

Dr. Omar Franklin Molina *received his D.D.S. degree in 1978 from the State University, Rio Grande do Sul, Brazil. He completed graduate studies at the State University of Santa Catarina, Brazil, receiving an M.S. degree in 1983. In 1983-1984 he specialized in orthodontics at the State University, Rio de Janeiro, Brazil and then attended advanced courses in occlusion and CMD in the United States. Dr. Molina has been a member of the American Equilibration Society since 1987 and has lectured on occlusion, facial pain and parafunctional habits in Brazil. He has published two books and is currently an instructor of advanced courses in CMD at The Brazilian Institute of Orthodontics, Rio de Janeiro. Dr. Molina is a member of The Center for Study of Craniomandibular Disorders at Porto Alegre, Brazil.*

Only a few studies have reported severity of bruxing behavior in specific groups of CMD patients.[1-3] Identification of diagnostic subgroups is relevant if treatment responses and prognosis are to be understood, particularly in patients presenting signs and symptoms of craniomandibular disorders including chronic orofacial pain and bruxing behavior. Bailey[4] stated that severe and chronic bruxing behavior decreases the ability to experience restorative sleep. Because destructive effects of bruxing behavior may occur in different structures of the masticatory system, it would be interesting to gain deeper insight about which particular disorders could be associated with severe bruxing behavior.

Attempts to study and classify bruxing behavior have been made in the last three decades using several approaches: personality profiles,[5] severity of tooth wear,[6] polysomnography,[7] electromyography,[8] clinical signs and symptoms,[9] time of the day,[10] body position in which it occurs,[11] self-report questionnaire and clinical examination,[12] and probably many other strategies. Bruxism is commonly classified as diurnal and/or nocturnal and of

the clenching and/or grinding type. All are considered different disorders occurring at different stages of consciousness with diverse etiologic factors. In all cases, individual therapeutic approaches are recommended.[13]

Despite the common clinical and epidemiological correlations of grinding and/or clenching behavior to specific muscle and joint disorders, the classification and definition of different diagnostic subgroups is mandatory in view of the need for more accurate diagnosis and treatment. This may be particularly true for patients presenting internal joint derangements and chronic orofacial pain.

Since it is troublesome to use sophisticated instrumentation to assess large samples of CMD and bruxing patients to classify them by the degree of severity, it would be advantageous to evaluate combinations of symptoms. Ware and Rugh[1] used a polysomnography (PSG) method to assess the pattern of bruxism, its association with leg movements and its relationship to sleep stages to classify their patients into destructive and depressed groups. According to one study, bruxing subtypes were classifiable according to different dimensions.[14] Clinical experience suggests that parafunctional activity exacerbates internal joint derangements, and interferes with the therapeutic response to the derangement.[15] According to the International Association of Sleep Disorders,[16] severe bruxism which occurs nightly is evidenced by dental injury (including tooth wear), periodontal breakdown, musculoskeletal pain or temporomandibular disorders and may be related to severe psychosocial events.

Internal Joint Derangement (IJD) including retrodiskal pain, disk-attachment pain, capsulitis, disk displacement with or without reduction and locking, may be exacerbated by moderate and severe bruxism. Clinical studies combined with neuroanatomical labeling data lead to the conclusion that heavy clenching (centric bruxism) is responsible for the initiation and continuation of emetic symptoms (nausea and vomiting) in CMD.[17] Under normal conditions, the joint disk is capable of resisting loading related to chewing, swallowing and mild clenching. Therefore, the purpose of this study was to:

1. Classify bruxers according to the degree of severity using a combination of questionnaire and clinical examination;
2. Assess the prevalence of specific joint disorders in three differentiated groups of bruxers; and
3. Test the hypothesis that increased loading is very damaging to the joints and, therefore we may expect to find a higher prevalence of specific joint and muscle disorders, including difficulties opening the mouth, transient locking, retrodiskal pain, capsulitis and disk-attachment pain in severe bruxers as compared to mild and moderate ones.

Materials and Methods

Information about the frequency of signs and symptoms of CMD, headaches and bruxing behavior, was gathered from a population of CMD patients referred to a Center for the Study of CMD and Facial Pain for diagnosis and treatment. This population consisted of a sample of 276 CMD patients referred over a period of four years. There were 236 females and 40 males and the mean age of the group was about 34.85 years (range 12-73). The following protocol was used initially to diagnose and classify patients as presenting CMD and mild, moderate, and severe bruxing behavior:

1. A set of questionnaires;
2. History of signs and symptoms;
3. Clinical examination including palpation of muscles and joints, evaluation of jaw movements, analysis of the occlusion, search for trigger points and patterns of referred pains, and application of diagnostic tests to assess the presence of MPDS and/or specific joint disorders. Dental casts, panoramic, transcranial, tomographic and or MR imaging, when necessary, were used to complement the diagnosis.

Once patients were diagnosed as presenting CMD, part of the comprehensive questionnaire was used to diagnose patients as presenting with or without bruxing behavior (daytime or nighttime bruxism).

Specific criteria to diagnose patients as presenting CMD are included in **Figures 1** to **4**.

All CMD patients, bruxers and non-bruxers, fit the criteria and were seeking active treatment for their symptoms. Some patients had been taking self-prescribed drugs, including analgesics and myorelaxants to reduce muscle, joint and/or headache pain, before the visit for examination and diagnosis. Once the patients were diagnosed as presenting CMD, they completed another questionnaire to gather information about bruxing behavior, first to determine if patients were CMD and bruxers, and then, based on the number of bruxism-related signs and symptoms, they were allocated to mild, moderate or severe groups.

Specific criteria to allocate CMD and bruxer patients to specific groups of bruxing behavior included the following:

1. Presence of wear facets of the teeth;
2. Recent history (last six months) of noises associated with nocturnal teeth grinding as reported by a friend, relative, and/or spouse;
3. Anamnestic report of catching himself/herself

CAPSULITIS:
1. Pain on palpation over the joints;
2. Joint pain occurring during wide jaw opening and when the patient is instructed to keep the mouth wide open for one minute;
3. Wide jaw opening pain is immediately abolished by having the patient clench the jaw.

RETRODISKAL PAIN:
1. Pain occurs when manipulating the jaw into CR position;
2. Pain elicited when the patient clenches in CO position;
3. Pain induced by biting in the CO position is immediately abolished when the patient clenchs on a cotton roll;
4. Pain elicited by pressing the minor finger in the posterior area of the joint via external acoustic meatus.

DISK-ATTACHMENT PAIN:
1. Persistent joint pain correlated with jaw movements;
2. Joint noises and a feeling of obstruction during jaw movements;
3. Presence of intermittent and transient locking;
4. Clinical evidence that the disorder is refractory to conventional CMD therapy.

Figure 1
Specific criteria to consider patients as presenting signs and symptoms of capsulitis, retrodiskal pain and disk-attachment pain.

clenching the teeth during the day;
4. Anamnestic information of feeling tension and stiffness during the day;
5. Anamnestic account of feeling tension and stiffness upon awakening;
6. Anamnestic report of awakening frequently at night grinding or clenching;
7. Hypertrophy of the masseter and/or temporalis muscle;
8. Feeling of fatigue on the masseter muscles on awakening;
9. Feeling of fatigue on the masseter muscles during the day;
10. Report of awakening at night or in the morning with the jaws locked;
11. Cervical pain on awakening;
12. Awakening in the morning with pain in the masseter and/or in the temporalis muscles;
13. Feeling of body fatigue and/or feeling of having slept poorly when awakening in the morning;
14. Toothache or feeling of discomfort of the teeth on awakening;
15. Recent history of chronic dislocation of permanent or temporary restorations.

Patients scoring 3-5 points in the above list of 15 items were considered mild, those scoring 6-10 points were

PROTECTIVE SPLINTING:
1. Anamnestic presence of myalgia;
2. Tenderness to palpation;
3. Restriction of jaw movements;
4. No pain at rest;
5. Feeling of muscle weakness;
6. Pain when performing normal or border movements.

MASTICATORY PAIN:
1. Anamnestic presence of chewing pain;
2. Anamnestic pain associated with jaw movements which lasts for a short period of time;
3. Presence of tenderness to palpation in the anatomic area of pain;
4. No pain at rest;
5. Patient starts using soft foods to prevent pain and discomfort.

MPDS:
1. Anamnestic pain in one or more known anatomic areas;
2. Presence of tender taut bands;
3. Presence of small nodules detected with the fingers and if compressed more tender to palpation. May elicit behavior or verbal responses;
4. Palpation of the trigger points (TP) may elicit referred pain and eventual autonomic responses (lacrimation, nausea);
5. Painful anatomic area readily correlated with known TP (ear pain associated with TP in the deep masseter muscle and/or in the clavicular division of sternocleidomastoid muscle; headache and neck pain associated with TP in anterior temporal, trapezius and/or sternocleidomastoid muscles.

Figure 2
Specific criteria to indicate diagnosis of protective splinting, masticatory pain and myofascial pain dysfunction syndrome(MPDS).

classified as moderate, and those scoring 11 points or higher were considered as severe bruxers. This scale of severity was designed and developed keeping in mind that it would be validated or at least be clinically acceptable if epidemiological findings in 211 bruxers

DISK DISPLACEMENT
WITH REDUCTION

1. Patient reports joint noises;
2. Reciprocal click (click on opening followed by a click on closing). Click diagnosed by intrameatal palpation and/or by the use of a stethoscope;
3. Noise disappears during mandibular protrusion and when the patient is instructed to open and close in this position.
4. Normal or reduced degree of jaw opening.

Figure 3
Specific criteria to classify patients as presenting disk displacement with reduction.

VASCULAR PAIN:

1. Unilateral pain in the head;
2. Throbbing or pulsatile pain;
3. Central excitatory effects including nausea, vomiting and visual disturbances during headache pain episodes;
4. Throbbing quality more evident as severity increases;
5. Patients medicated with aeusaldine, cafergot and/or hormigraine (ergotamine tartrate) to relieve pain;

TENSION HEADACHE:

1. Bilateral pain on the forehead-temple or on the occipital-suboccipital areas (radiating from the posterior to the anterior area of the head or vice versa);
2. Pain described as steady, constant, lasting hours, having no throbbing quality (cannot be relieved by analgesics and myorelaxants):
3. Pain described as "tightening, pressing or compressing";
4. Headache attacks occurring two or more times per week;

COMBINATION HEADACHE:

1. Headache occurring unilaterally or bilaterally. Unilateral headache has the characteristics of vascular pain, whereas bilateral headache has the characteristics of tensional headache;
2. Presence of photophobia, nausea and vomiting particularly during the severe, throbbing, unbearable episodes of the vascular component of combination headache.

Figure 4
Specific criteria for vascular, tensional and combination headaches observed frequently in CMD patients.

demonstrated a significantly higher prevalence of specific muscle and joint disorders.

Results

Of the total group of 276 CMD patients, 100 (36.23%) presented mild, 66 (23.91%) demonstrated moderate and 45 (16.30%) severe bruxism. The prevalence of mild bruxism in 211 bruxers was 47.39% (100 patients), moderate bruxism 31.27% (66 patients), and severe bruxism 21.33% (45 patients).

Tables 1 through **5** describe the results of our study. According to statistical analysis for differences in percentages and a test of trends to check if the change in percentages corresponded to the trend from CMD-nonbruxer to CMD+bruxers (mild to moderate to severe), the results were: *sex*, not significantly different for both tests ($p>0.8$) (**Table 6**); *capsulitis*, significant ($p = 0.011$ for test of differences, regardless of trend and trend $p = 0.024$) (**Table 7**); retrodiskal pain, highly significant for both tests ($p<0.001$)(**Table 8**); *disk-attachment pain*, highly significant for both tests ($p<0.001$) (**Table 9**); *protective splinting*, significant ($p = 0.016$ for test of differences, regardless of trend and trend $p = 0.013$) (**Table 10**); *locking*, highly significant for both tests ($p<0.001$) (**Table 11**); *headache*, highly significant ($p = 0.009$ for differences, regardless of trend and trend $p = 0.002$)(**Table 12**); *masticatory pain*, highly significant for both tests ($p<0.001$) (**Table 13**); *reciprocal clicking*, highly significant for differences, regardless of trend ($p = 0.004$), but not significant for trend ($p = 0.175$) (**Table 14**); and *MPDS*, highly significant for both tests ($p<0.001$) (**Table 15**).

Discussion

Severe Bruxism

In our study, of the total group of 211 bruxers, 45 patients (21.32%) evidenced signs and symptoms of severe bruxism. Clarke, et al.,[18] using EMG methods to study the patterns of bruxism during sleep in ten patients presenting signs and symptoms of bruxing behavior, found that only two patients in the group they studied exceeded a force (during nocturnal bruxism) that could be equivalent to a maximum conscious force and might be contemplated as severe bruxers. Even considering the different methodology of their study when compared to ours, the 20% severe nocturnal bruxers was very similar to the prevalence of 21.32% severe bruxers observed in our study. This prevalence was different from 13.00% observed by Johansson, et al.,[19] but they used the rate of progression of tooth wear to assess severity and only 85% of their subjects complained of bruxing behavior.

Ware and Rugh[1] used a PSG method to assess 26 patients presenting with signs and symptoms of bruxing behavior and found 19.23% severe (destructive) bruxism that is very similar to what we observed in our study. It is noteworthy to mention that Ware and Rugh's description of the severe group with regard to signs and symptoms was very similar to the clinical complaints of our 45 severe bruxers.

Degree of Jaw Opening

The severe bruxing behavior presented the lowest degree of jaw opening (39.21 mm) (**Table 2**) as compared to other groups. Severe bruxers seem to be more impaired by their muscle and joint disorders reflected by muscle pain, difficulties opening the jaw and intermittent locking. The whole group of bruxers demonstrated a mean degree of jaw opening of 42.19 mm. Because heavy bruxers presented a higher prevalence of bilateral capsulitis, it was expected that they would also display increased reflex protective activity from the joint capsule and muscles, thus leading to more limitation when performing jaw movements. Mejias and Mehta[20] found that 20% of bruxers presented limited jaw opening, but their

Table 1
Characteristics of CMD+Bruxers and CMD Non-bruxers by Sex and Age

	CMD+Bruxers N=211						CMD Nonbruxers N=65	
	Mild N=100		Moderate N=66		Severe N=45		Nonbruxers N=65	
	N	%	N	%	N	%	N	%
Females	84	84.0	57	86.36	39	86.67	56	86.15
Males	16	16.0	9	13.64	6	13.33	9	13.85
Totals	100	100.0	66	100.0	45	100.0	65	100.0
Mean Age	34.62		33.86		33.88		37.04	
Range	16 - 58		17 - 57		12 - 73		17 - 60	
S.D.	9.54		9.23		8.98		8.26	

Table 2
Degree of Jaw Opening in the Mild, Moderate and Severe Groups of Bruxers and in the CMD Nonbruxers Group

	Mild N = 100	Moderate N = 66	Severe N = 45	Nonbruxers N = 65
Degree of jaw opening	45.8 mm	41.57 mm	39.21 mm	45.86 mm
Range	15 - 61 mm	15 - 55 mm	10 - 64 mm	20 - 62 mm
S.D.	7.91	9.12	9.06	6.64

Table 3
Prevalence of Capsulitis, Retrodiskal Pain and Disk-attachment Pain in the Groups of Mild, Moderate and Heavy Bruxers and in the CMD Nonbruxing Group

	Mild N=100		Moderate N=66		Severe N=45		CMD Nonbruxers N=65	
	n	%	n	%	n	%	n	%
Capsulitis	78	78.0	58	87.87	44	97.77	55	84.61
Retrodiskal Pain	15	15.0	23	34.85	38	84.44	4	6.15
Disk-attachment Pain	5	5.0	6	9.09	22	48.88	3	4.62

sample was too small (ten patients) to warrant any discussion. The degree of jaw opening (39.21 mm) we found in our group of severe bruxers was close to that observed by Seligman and Pullinger,[21] (38.50 mm) in CMD patients who presented with locking or a history of locking and demonstrated common characteristics comparable to our group of bruxers.

Sjoholm,et al.[22] found a mean degree of jaw opening of approximately 49.0 mm in teeth grinders as compared to 42.19 mm observed in our 211 bruxers. The small sample size (12 patients) and the lower prevalence of capsulitis (41.66%) observed in their patients could be responsible for the difference in prevalence. The lowest degree of jaw opening was observed in internal joint derangement patients presented in a study showing the highest prevalence of bruxing behavior.[23] In another associated study, this parafunctional behavior showed a decreased range of mandibular opening, jaw catching and locking.[24]

Table 4
Prevalence of Protective Splinting, Locking, or History of Transient Locking and Headache in the Mild, Moderate and Severe Groups of Bruxers and in the CMD Nonbruxing Group

	Mild N=100		Moderate N=66		Severe N=45		CMD Nonbruxers N=65	
	n	%	n	%	n	%	n	%
Protective Splinting	39	39.0	29	43.93	30	66.66	27	41.53
Locking or history of locking	23	23.0	18	27.27	33	73.33	20	30.76
Headache	56	56.0	48	72.72	36	80.00	37	56.92

Table 5
Prevalence of Masticatory Pain, Reciprocal Clicking and MPDS in the Three Groups of Bruxers and the CMD Nonbruxing Group

	Mild N=100		Moderate N=66		Severe N=45		CMD Nonbruxers N=65	
	n	%	n	%	n	%	n	%
Masticatory pain	32	32.0	40	60.60	33	73.33	17	26.15
Reciprocal click	22	22.0	19	28.78	23	51.15	25	38.46
MPDS	37	37.0	29	43.93	35	77.77	25	38.46

Capsulitis

Two hundred thirty-five patients (85.14%) of 276 CMD patients exhibited capsulitis. The prevalence of this disorder by groups is shown in **Table 3**. Our findings were similar to the prevalence of 68% of capsulitis observed by Cooper and Cooper[25] and 75.5% observed by Brown and Gauder[26] in CMD patients. We detected no highly significant differences in the three groups, but severe bruxers showed a higher evidence of bilateral capsulitis, possibly suggesting that heavy bruxers may present increased nociceptive input from the joints and more protective splinting from the masticatory muscles. Kampe, et al.[27] observed about 76% of capsulitis in 29 patients with longstanding bruxing behavior. Because bruxism may not be the only cause of capsulitis, further studies are needed to elucidate the relationship between bilateral capsulitis, nocturnal bruxism and body posture. Increased loading may be a common characteristic in heavy bruxers, and this may contribute to the increased prevalence of bilateral capsulitis.

Retrodiskal Pain

Table 3 shows that 76 patients (36%) in 211 bruxers presented signs and symptoms of retrodiskal pain. The same table shows the distribution of patients in all groups. Brown, et al.[28] found 50.00% retrodiskitis in their 14 symptomatic subjects. They assessed a small sample palpating the retrodiskal tissues via external acoustic meatus to diagnose retrodiskitis. The prevalence we observed in our study was very similar to the frequency of 33.33% of "pain in the posterior area of the joint" found by Hesse, et al.[29] in twelve patients with CMD which included joint pain. Since we found a significantly higher prevalence of retrodiskal pain in the moderate and severe groups when compared to the mild and CMD-nonbruxing behavior group, it is likely that severe bruxism is a significant contributing factor to the development of pain in the retrodiskal tissues. Lund[30] stated that bruxism may cause pain, micro-trauma to the muscle fibers, excessive loading and dysfunction that occurs several hours following bruxing episodes. Additionally, tenderness of the lateral ligament and/or the posterior portion of the joint via the external auditory meatus indicates inflammation of the capsular, synovial or surrounding tissues.[31]

Disk-attachment Pain

As **Table 3** indicates, 33 patients (15.63%) out of 211 bruxers displayed disk-attachment pain. This same

Table 6
Differences in Percentage of Females and Males

Frequency / Raw Percentage	Females	Males	Total
CMD Nonbruxers	56	9	65
	86.15	13.85	
CMD+bruxers	84	16	100
Mild	84.0	16.0	
CMD+bruxers	57	9	66
Moderate	86.36	13.64	
CMD+bruxers	39	6	45
Severe	86.67	13.33	
Total	236	40	276

Statistics for Table of DX by Sex

Statistic	DF	Value	Prob
Chi Square	3	0.293	0.961
Likelihood ratio chi-square	3	0.290	0.962
Mantel-Haenszel chi-square (trend)	1	0.040	0.841
Fisher's Exact Test (2-tail) (differences)			0.970
Phi coefficient		0.033	
Contingency coefficient		0.033	
Cramer's V		0.033	

Sample size: 276

Table 7
Differences in Percentage With Capsulitis

Frequency / Raw Percentage	No	Yes	Total
CMD Nonbruxers	10	55	65
	15.38	84.62	
CMD+bruxers	22	78	100
Mild	22.0	78.0	
CMD+bruxers	8	58	66
Moderate	12.12	87.88	
CMD+bruxers	1	44	45
Severe	2.22	97.78	
Total	41	235	276

Statistics for Table of DX by Capsul

Statistic	DF	Value	Prob
Chi Square	3	10.118	0.018
Likelihood ratio chi-square	3	12.407	0.006
Mantel-Haenszel chi-square (trend)	1	5.123	0.024
Fisher's Exact Test (2-tail) (differences)			0.011
Phi coefficient		0.191	
Contingency coefficient		0.188	
Cramer's V		0.191	

Sample size: 276

Table 8
Differences in Percentage With Retrodiskal Pain

Frequency / Raw Percentage	No	Yes	Total
CMD Nonbruxers	61	4	65
	93.85	6.15	
CMD+bruxers	85	15	100
Mild	85.0	15.0	
CMD+bruxers	43	23	66
Moderate	65.15	34.85	
CMD+bruxers	7	38	45
Severe	15.56	84.44	
Total	196	80	276

Statistics for Table of DX by Ret-Pain

Statistic	DF	Value	Prob
Chi Square	3	94.306	0.001
Likelihood ratio chi-square	3	93.482	0.001
Mantel-Haenszel chi-square (trend)	1	81.122	0.001
Fisher's Exact Test (2-tail) (differences)			<0.001
Phi coefficient		0.585	
Contingency coefficient		0.505	
Cramer's V		0.585	

Sample size: 276

Table 9
Differences in Percentage With Disk-attachment Pain

Frequency / Raw Percentage	No	Yes	Total
CMD Nonbruxers	62	3	65
	95.38	4.62	
CMD+bruxers	95	5	100
Mild	95.0	5.0	
CMD+bruxers	60	6	66
Moderate	90.91	9.09	
CMD+bruxers	23	22	45
Severe	51.11	48.89	
Total	240	36	276

Statistics for Table of DX by D-A Pain

Statistic	DF	Value	Prob
Chi Square	3	61.662	0.001
Likelihood ratio chi-square	3	47.151	0.001
Mantel-Haenszel chi-square (trend)	1	38.583	0.001
Fisher's Exact Test (2-tail) (differences)			<0.001
Phi coefficient		0.473	
Contingency coefficient		0.427	
Cramer's V		0.473	

Sample size: 276

Table 10
Differences in Percentage
With Protective Splinting

Frequency Raw Percentage	No	Yes	Total
CMD Nonbruxers	38	27	65
	58.46	41.54	
CMD+bruxers	61	39	100
Mild	61.0	39.0	
CMD+bruxers	37	29	66
Moderate	56.06	43.94	
CMD+bruxers	15	30	45
Severe	33.33	66.67	
Total	151	125	276

Statistics for Table of DX by Protec Splint

Statistic	DF	Value	Prob
Chi Square	3	10.313	0.016
Likelihood ratio chi-square	3	10.366	0.016
Mantel-Haenszel chi-square (trend)	1	6.183	0.013
Fisher's Exact Test (2-tail) (differences)			0.016
Phi coefficient		0.193	
Contingency coefficient		0.190	
Cramer's V		0.193	

Sample size: 276

Table 11
Differences in Percentage
With Locking

Frequency Raw Percentage	No	Yes	Total
CMD Nonbruxers	45	20	65
	69.23	30.77	
CMD+bruxers	77	23	100
Mild	77.0	23.0	
CMD+bruxers	48	18	66
Moderate	72.73	27.27	
CMD+bruxers	12	33	45
Severe	26.67	73.33	
Total	182	94	276

Statistics for Table of DX by Locking

Statistic	DF	Value	Prob
Chi Square	3	38.019	0.001
Likelihood ratio chi-square	3	36.429	0.001
Mantel-Haenszel chi-square (trend)	1	17.201	0.001
Fisher's Exact Test (2-tail) (differences)			<0.001
Phi coefficient		0.371	
Contingency coefficient		0.348	
Cramer's V		0.371	

Sample size: 276

Table 12
Differences in Percentage
With Headache

Frequency Raw Percentage	No	Yes	Total
CMD Nonbruxers	28	37	65
	43.08	56.92	
CMD+bruxers	44	56	100
Mild	44.0	56.0	
CMD+bruxers	18	48	66
Moderate	27.27	72.73	
CMD+bruxers	9	36	45
Severe	20.0	80.0	
Total	99	177	276

Statistics for Table of DX by Headache

Statistic	DF	Value	Prob
Chi Square	3	11.389	0.010
Likelihood ratio chi-square	3	11.844	0.008
Mantel-Haenszel chi-square (trend)	1	9.360	0.002
Fisher's Exact Test (2-tail) (differences)			0.009
Phi coefficient		0.203	
Contingency coefficient		0.199	
Cramer's V		0.203	

Sample size: 276

Table 13
Differences in Percentage
With Masticatory Pain

Frequency Raw Percentage	No	Yes	Total
CMD Nonbruxers	48	17	65
	73.85	26.15	
CMD+bruxers	68	32	100
Mild	68.0	32.0	
CMD+bruxers	26	40	66
Moderate	39.39	60.61	
CMD+bruxers	12	33	45
Severe	26.67	73.33	
Total	154	122	276

Statistics for Table of DX by Mst Pain

Statistic	DF	Value	Prob
Chi Square	3	37.306	0.001
Likelihood ratio chi-square	3	38.124	0.001
Mantel-Haenszel chi-square (trend)	1	34.203	0.001
Fisher's Exact Test (2-tail) (differences)			<0.001
Phi coefficient		0.368	
Contingency coefficient		0.345	
Cramer's V		0.368	

Sample size: 276

Table 14
Differences in Percentage
With Reciprocal Clicking

Frequency Raw Percentage	No	Yes	Total
CMD Nonbruxers	40	25	65
	61.54	38.46	
CMD+bruxers	78	22	100
Mild	78.0	22.0	
CMD+bruxers	47	19	66
Moderate	71.71	28.79	
CMD+bruxers	22	23	45
Severe	48.89	51.11	
Total	187	89	276

Statistics for Table of DX by RCP Click

Statistic	DF	Value	Prob
Chi Square	3	13.646	0.003
Likelihood ratio chi-square	3	13.459	0.004
Mantel-Haenszel chi-square (trend)	1	1.843	0.175
Fisher's Exact Test (2-tail) (differences)			0.036
Phi coefficient		0.222	
Contingency coefficient		0.217	
Cramer's V		0.222	

Sample size: 276

Table 15
Differences in Percentage
With MPDS

Frequency Raw Percentage	No	Yes	Total
CMD Nonbruxers	40	25	65
	61.54	38.46	
CMD+bruxers	63	37	100
Mild	63.0	37.0	
CMD+bruxers	37	29	66
Moderate	56.06	43.94	
CMD+bruxers	10	35	45
Severe	22.22	77.78	
Total	150	126	276

Statistics for Table of DX by MPDS

Statistic	DF	Value	Prob
Chi Square	3	23.168	0.001
Likelihood ratio chi-square	3	23.923	0.001
Mantel-Haenszel chi-square (trend)	1	15.055	0.001
Fisher's Exact Test (2-tail) (differences)			<0.001
Phi coefficient		0.290	
Contingency coefficient		0.278	
Cramer's V		0.290	

Sample size: 276

table shows the distribution between groups. Hesse, et al.[29] found approximately 55.55% of arthrogenous pain, unilateral closed lock and mean degree of jaw opening of about 38 mm in patients with clinical characteristics closely resembling those presented in our group of severe bruxers. Their data is only comparable to the prevalence of 48.88% of disk-attachment pain observed in our group of severe bruxers in which intermittent locking, history of locking and persistent joint pain were common findings. Eriksson and Westesson[32] performed a clinical and radiological study of patients with anterior disk displacement. They found 33.33% of anterior disk displacement with reduction in patients with transient locking. This high prevalence as compared to our study (15.63%) is probably related to the selection criteria in Eriksson and Westesson study. All patients in their study presented signs and symptoms of disk displacement with or without reduction. Seligman and Pullinger[21] found 6.86% of disk derangements, persistent condylar restriction, possible localized arthralgia, history of clicking, transient locking and mean degree of jaw opening of 38.5 mm, that is, clinical characteristics similar to those present in our group of 33 patients presenting disk-attachment pain. The high prevalence we observed may be related to the fact that all 211 patients were bruxers. Nitzan and Dolwick[23] found 32% of disk displacement with reduction and intermittent locking. Their patients presented similar clinical characteristics to our patients with disk-attachment pain. The percentage they found was similar to the 48.88% disk-attachment pain observed in our group of 45 severe bruxism patients. However, the prevalence of 15.63% disk-attachment pain we observed was similar to the presence of about eight percent locking or dislocation of the mandible observed by Hanamura, et al.[33] in 40 bruxers. Because we found significantly higher prevalence of disc-attachment pain in moderate and severe bruxers as compared to the mild and CMD-nonbruxing groups, these findings are in accordance with our initial suggestion that bruxism could be a significant factor causing overloading to the joint. Our premise that specific joint disorders would increase with the severity of bruxism are also supported by those of Lund, Westesson and Kopp,[34] who observed that the patients who developed locking had at initial examination intense pain, frequent joint tenderness (suggesting capsulitis), dental abrasion (implying more severe bruxism) and lack of molar support on the affected side. The severe bruxers in the study performed by Ware and Rugh[1] presented more persistent pain and

history of periodic locking indicating high prevalence of disk attachment pain.

Protective Splinting

Table 4 demonstrates that 98 patients (46.44%) in 211 bruxers presented protective splinting. This same table describes the distribution among groups. Helkimo and Westling[35] found 62% restriction of jaw opening in 55 patients presenting anterior disk displacement, in which 82% were grinders or clenchers. Because all patients in Helkimo and Westling's group presented anterior disk displacement, it is likely this high percentage may represent the higher frequency of restricted opening. Agerbeg and Helkimo[36] found 32% restriction to opening wide or biting over a large bolus but only 37% of CMD patients were bruxers. It is apparent that heavy bruxers present the highest incidence of protective splinting.

Intermittent Locking

We found a prevalence of approximately 35.07% (74 patients) intermittent locking or recent history of locking. **Table 4** presents the distribution between groups and illustrates that the frequency increased with the severity of bruxism. Since we found a significantly higher prevalence of this disorder in the severe group, it is likely that the bruxing behavior is an important factor in the etiology and perhaps also in continuation of locking. Agerberg and Helkimo[36] observed 16% of "luxation and locking" in CMD patients, but evidence of bruxism was only 37%. The prevalence we found was similar to the frequency of 32% intermittent locking observed by Nitzan and Dolwick.[23] They performed a study of 194 joints but only 50% of patients were bruxers. Kerstein[37] found 22.54% jaw locking as compared to 35.07% in our study. All Kerstein's patients presented signs and symptoms of MPDS and not all of them were bruxers. Solberg, et al.[24] assessed the detection of mandibular dysfunction in young adults and associated bruxism with decreased range of mandibular opening and catching/locking.

Headache

We found a prevalence of 66.35% (140 patients) headache pain in 211 bruxers and the distribution of groups is shown in **Table 4**. This prevalence was not very different from the 86.66% headache observed by Hamada, et al.[38] in a small sample of bruxers. Yustin, et al.[39] found 60.4% headaches or neck aches in a group of bruxers. Hanamura, et al.[33] observed a frequency of approximately 48% in CMD+ bruxing behavior patients.

Masticatory Pain

Table 5 shows that the prevalence of masticatory pain in 276 CMD (bruxers and nonbruxers) was 44.2% (122 patients). The same table shows the distribution between groups. The frequency of the disorder increased with the severity of bruxism. The detection of this disorder in 105 patients in a group of 211 bruxers (49.76%) was similar to the 36.80% frequency observed by Dao, et al.[40] in patients presenting bruxism and masticatory pain. Agerberg and Helkimo[36] observed 22% of "chewing difficulties" but only 37% of them were bruxers. Nitzan and Dolwick[23] suggested that severely limited mandibular opening and probably pain and difficulties performing normal jaw movements may be the result of sustained pressured applied to the joints as a result of severe bruxism. Ren and Isberg[41] observed 53.9% "painful chewing" in CMD-internal joint derangement patients.

Reciprocal Click

Table 5 shows that 64 patients (30.33%) in 211 in the CMD+bruxing behavior group presented reciprocal click. The frequency of reciprocal click increased with the severity of bruxism. Lobbezoo, et al.[42] found only 20% reciprocal clicking in CMD patients, but not all of them were bruxers. Our findings were closer to the 27% reciprocal clicking observed by Isaacson, et al.[43] in 170 CMD patients. Nitzan and Dolwick[23] observed 32% disk displacement with reduction and intermittent locking in 135 patients, but only 50% of them presented bruxing behavior.

Myofascial Pain Dysfunction Syndrome (MPDS)

Table 5 demonstrated that the prevalence of MPDS in 211 CMD and bruxing behavior was 47.86% (101 patients) and also shows the distribution among groups. Signs and symptoms of MPDS increased with the severity of bruxism. The prevalence we observed was similar to the frequency of 55.4% observed by Fricton, et al.,[44] in 296 chronic facial and head pain patients referred consecutively for diagnosis and treatment. The higher prevalence they found may be related to the fact that patients in their groups were referred to a "chronic pain program" and consequently presented more chronic muscular, joint and psychological disorders. The prevalence we found in our study was also similar to the 51% MPDS found by Lundeen, et al.[31] It is generally accepted that micro trauma and bad posture are common causes for signs and symptoms of MPDS. Because bruxing behavior is a form of repetitive micro-trauma and is associated with abnormal posture of the lower jaw, there is no doubt that bruxing behavior is a significant factor contributing to the development of signs and symptoms of MPDS. The development of trigger points may also be brought on by direct injury, other parafunctional jaw habits, stress and

systemic disorders.[45] The fact that a higher prevalence of MPDS was observed in severe bruxers provides additional support to the general assumption regarding the role of repetitive micro-trauma as a significant factor in the development of trigger points.

Conclusions

Data in this study revealed a higher prevalence of specific muscle and joint disorders in severe bruxers when compared to mild and moderate bruxers, and to the CMD nonbruxing group as well. It suggests that severe bruxers are more impaired by muscle and joint disorders. Such complaints are related to increased nociceptive input from different areas of the masticatory system. It probably suggests a differentiated approach to the complaints of severe bruxers, e.g., more modes of therapy, unloading the jaws and muscles (for longer periods of time).

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